

F 65

.K27

UNIVERSITY OF PENNSYLVANIA

SOME INFLUENCES OF ENVIRONMENT
IN MASSACHUSETTS

BY
MALCOLM KEIR

A THESIS
PRESENTED TO THE FACULTY OF THE GRADUATE SCHOOL IN
PARTIAL FULFILLMENT OF THE REQUIREMENTS FOR
THE DEGREE OF DOCTOR OF PHILOSOPHY

PRESS OF
THE NEW ERA PRINTING COMPANY
LANCASTER, PA.

1917



PLATE I. HOOSICK VALLEY AT WILLIAMSTOWN, MASS. One of the dairy districts of western Massachusetts.

UNIVERSITY OF PENNSYLVANIA

SOME INFLUENCES OF ENVIRONMENT
IN MASSACHUSETTS

BY
MALCOLM KEIR

A THESIS
PRESENTED TO THE FACULTY OF THE GRADUATE SCHOOL IN
PARTIAL FULFILLMENT OF THE REQUIREMENTS FOR
THE DEGREE OF DOCTOR OF PHILOSOPHY

2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22
23
24
25
26
27
28
29
30
31
32
33
34
35
36
37
38
39
40
41
42
43
44
45
46
47
48
49
50
51
52
53
54
55
56
57
58
59
60
61
62
63
64
65
66
67
68
69
70
71
72
73
74
75
76
77
78
79
80
81
82
83
84
85
86
87
88
89
90
91
92
93
94
95
96
97
98
99
100
101
102
103
104
105
106
107
108
109
110
111
112
113
114
115
116
117
118
119
120
121
122
123
124
125
126
127
128
129
130
131
132
133
134
135
136
137
138
139
140
141
142
143
144
145
146
147
148
149
150
151
152
153
154
155
156
157
158
159
160
161
162
163
164
165
166
167
168
169
170
171
172
173
174
175
176
177
178
179
180
181
182
183
184
185
186
187
188
189
190
191
192
193
194
195
196
197
198
199
200
201
202
203
204
205
206
207
208
209
210
211
212
213
214
215
216
217
218
219
220
221
222
223
224
225
226
227
228
229
230
231
232
233
234
235
236
237
238
239
240
241
242
243
244
245
246
247
248
249
250
251
252
253
254
255
256
257
258
259
260
261
262
263
264
265
266
267
268
269
270
271
272
273
274
275
276
277
278
279
280
281
282
283
284
285
286
287
288
289
290
291
292
293
294
295
296
297
298
299
300
301
302
303
304
305
306
307
308
309
310
311
312
313
314
315
316
317
318
319
320
321
322
323
324
325
326
327
328
329
330
331
332
333
334
335
336
337
338
339
340
341
342
343
344
345
346
347
348
349
350
351
352
353
354
355
356
357
358
359
360
361
362
363
364
365
366
367
368
369
370
371
372
373
374
375
376
377
378
379
380
381
382
383
384
385
386
387
388
389
390
391
392
393
394
395
396
397
398
399
400
401
402
403
404
405
406
407
408
409
410
411
412
413
414
415
416
417
418
419
420
421
422
423
424
425
426
427
428
429
430
431
432
433
434
435
436
437
438
439
440
441
442
443
444
445
446
447
448
449
450
451
452
453
454
455
456
457
458
459
460
461
462
463
464
465
466
467
468
469
470
471
472
473
474
475
476
477
478
479
480
481
482
483
484
485
486
487
488
489
490
491
492
493
494
495
496
497
498
499
500
501
502
503
504
505
506
507
508
509
510
511
512
513
514
515
516
517
518
519
520
521
522
523
524
525
526
527
528
529
530
531
532
533
534
535
536
537
538
539
540
541
542
543
544
545
546
547
548
549
550
551
552
553
554
555
556
557
558
559
560
561
562
563
564
565
566
567
568
569
570
571
572
573
574
575
576
577
578
579
580
581
582
583
584
585
586
587
588
589
590
591
592
593
594
595
596
597
598
599
600
601
602
603
604
605
606
607
608
609
610
611
612
613
614
615
616
617
618
619
620
621
622
623
624
625
626
627
628
629
630
631
632
633
634
635
636
637
638
639
640
641
642
643
644
645
646
647
648
649
650
651
652
653
654
655
656
657
658
659
660
661
662
663
664
665
666
667
668
669
670
671
672
673
674
675
676
677
678
679
680
681
682
683
684
685
686
687
688
689
690
691
692
693
694
695
696
697
698
699
700
701
702
703
704
705
706
707
708
709
710
711
712
713
714
715
716
717
718
719
720
721
722
723
724
725
726
727
728
729
730
731
732
733
734
735
736
737
738
739
740
741
742
743
744
745
746
747
748
749
750
751
752
753
754
755
756
757
758
759
760
761
762
763
764
765
766
767
768
769
770
771
772
773
774
775
776
777
778
779
780
781
782
783
784
785
786
787
788
789
790
791
792
793
794
795
796
797
798
799
800
801
802
803
804
805
806
807
808
809
810
811
812
813
814
815
816
817
818
819
820
821
822
823
824
825
826
827
828
829
830
831
832
833
834
835
836
837
838
839
840
841
842
843
844
845
846
847
848
849
850
851
852
853
854
855
856
857
858
859
860
861
862
863
864
865
866
867
868
869
870
871
872
873
874
875
876
877
878
879
880
881
882
883
884
885
886
887
888
889
890
891
892
893
894
895
896
897
898
899
900
901
902
903
904
905
906
907
908
909
910
911
912
913
914
915
916
917
918
919
920
921
922
923
924
925
926
927
928
929
930
931
932
933
934
935
936
937
938
939
940
941
942
943
944
945
946
947
948
949
950
951
952
953
954
955
956
957
958
959
960
961
962
963
964
965
966
967
968
969
970
971
972
973
974
975
976
977
978
979
980
981
982
983
984
985
986
987
988
989
990
991
992
993
994
995
996
997
998
999
1000
1001
1002
1003
1004
1005
1006
1007
1008
1009
1010
1011
1012
1013
1014
1015
1016
1017
1018
1019
1020
1021
1022
1023
1024
1025
1026
1027
1028
1029
1030
1031
1032
1033
1034
1035
1036
1037
1038
1039
1040
1041
1042
1043
1044
1045
1046
1047
1048
1049
1050
1051
1052
1053
1054
1055
1056
1057
1058
1059
1060
1061
1062
1063
1064
1065
1066
1067
1068
1069
1070
1071
1072
1073
1074
1075
1076
1077
1078
1079
1080
1081
1082
1083
1084
1085
1086
1087
1088
1089
1090
1091
1092
1093
1094
1095
1096
1097
1098
1099
1100
1101
1102
1103
1104
1105
1106
1107
1108
1109
1110
1111
1112
1113
1114
1115
1116
1117
1118
1119
1120
1121
1122
1123
1124
1125
1126
1127
1128
1129
1130
1131
1132
1133
1134
1135
1136
1137
1138
1139
1140
1141
1142
1143
1144
1145
1146
1147
1148
1149
1150
1151
1152
1153
1154
1155
1156
1157
1158
1159
1160
1161
1162
1163
1164
1165
1166
1167
1168
1169
1170
1171
1172
1173
1174
1175
1176
1177
1178
1179
1180
1181
1182
1183
1184
1185
1186
1187
1188
1189
1190
1191
1192
1193
1194
1195
1196
1197
1198
1199
1200
1201
1202
1203
1204
1205
1206
1207
1208
1209
1210
1211
1212
1213
1214
1215
1216
1217
1218
1219
1220
1221
1222
1223
1224
1225
1226
1227
1228
1229
1230
1231
1232
1233
1234
1235
1236
1237
1238
1239
1240
1241
1242
1243
1244
1245
1246
1247
1248
1249
1250
1251
1252
1253
1254
1255
1256
1257
1258
1259
1260
1261
1262
1263
1264
1265
1266
1267
1268
1269
1270
1271
1272
1273
1274
1275
1276
1277
1278
1279
1280
1281
1282
1283
1284
1285
1286
1287
1288
1289
1290
1291
1292
1293
1294
1295
1296
1297
1298
1299
1300
1301
1302
1303
1304
1305
1306
1307
1308
1309
1310
1311
1312
1313
1314
1315
1316
1317
1318
1319
1320
1321
1322
1323
1324
1325
1326
1327
1328
1329
1330
1331
1332
1333
1334
1335
1336
1337
1338
1339
1340
1341
1342
1343
1344
1345
1346
1347
1348
1349
1350
1351
1352
1353
1354
1355
1356
1357
1358
1359
1360
1361
1362
1363
1364
1365
1366
1367
1368
1369
1370
1371
1372
1373
1374
1375
1376
1377
1378
1379
1380
1381
1382
1383
1384
1385
1386
1387
1388
1389
1390
1391
1392
1393
1394
1395
1396
1397
1398
1399
1400
1401
1402
1403
1404
1405
1406
1407
1408
1409
1410
1411
1412
1413
1414
1415
1416
1417
1418
1419
1420
1421
1422
1423
1424
1425
1426
1427
1428
1429
1430
1431
1432
1433
1434
1435
1436
1437
1438
1439
1440
1441
1442
1443
1444
1445
1446
1447
1448
1449
1450
1451
1452
1453
1454
1455
1456
1457
1458
1459
1460
1461
1462
1463
1464
1465
1466
1467
1468
1469
1470
1471
1472
1473
1474
1475
1476
1477
1478
1479
1480
1481
1482
1483
1484
1485
1486
1487
1488
1489
1490
1491
1492
1493
1494
1495
1496
1497
1498
1499
1500
1501
1502
1503
1504
1505
1506
1507
1508
1509
1510
1511
1512
1513
1514
1515
1516
1517
1518
1519
1520
1521
1522
1523
1524
1525
1526
1527
1528
1529
1530
1531
1532
1533
1534
1535
1536
1537
1538
1539
1540
1541
1542
1543
1544
1545
1546
1547
1548
1549
1550
1551
1552
1553
1554
1555
1556
1557
1558
1559
1560
1561
1562
1563
1564
1565
1566
1567
1568
1569
1570
1571
1572
1573
1574
1575
1576
1577
1578
1579
1580
1581
1582
1583
1584
1585
1586
1587
1588
1589
1590
1591
1592
1593
1594
1595
1596
1597
1598
1599
1600
1601
1602
1603
1604
1605
1606
1607
1608
1609
1610
1611
1612
1613
1614
1615
1616
1617
1618
1619
1620
1621
1622
1623
1624
1625
1626
1627
1628
1629
1630
1631
1632
1633
1634
1635
1636
1637
1638
1639
1640
1641
1642
1643
1644
1645
1646
1647
1648
1649
1650
1651
1652
1653
1654
1655
1656
1657
1658
1659
1660
1661
1662
1663
1664
1665
1666
1667
1668
1669
1670
1671
1672
1673
1674
1675
1676
1677
1678
1679
1680
1681
1682
1683
1684
1685
1686
1687
1688
1689
1690
1691
1692
1693
1694
1695
1696
1697
1698
1699
1700
1701
1702
1703
1704
1705
1706
1707
1708
1709
1710
1711
1712
1713
1714
1715
1716
1717
1718
1719
1720
1721
1722
1723
1724
1725
1726
1727
1728
1729
1730
1731
1732
1733
1734
1735
1736
1737
1738
1739
1740
1741
1742
1743
1744
1745
1746
1747
1748
1749
1750
1751
1752
1753
1754
1755
1756
1757
1758
1759
1760
1761
1762
1763
1764
1765
1766
1767
1768
1769
1770
1771
1772
1773
1774
1775
1776
1777
1778
1779
1780
1781
1782
1783
1784
1785
1786
1787
1788
1789
1790
1791
1792
1793
1794
1795
1796
1797
1798
1799
1800
1801
1802
1803
1804
1805
1806
1807
1808
1809
1810
1811
1812
1813
1814
1815
1816
1817
1818
1819
1820
1821
1822
1823
1824
1825
1826
1827
1828
1829
1830
1831
1832
1833
1834
1835
1836
1837
1838
1839
1840
1841
1842
1843
1844
1845
1846
1847
1848
1849
1850
1851
1852
1853
1854
1855
1856
1857
1858
1859
1860
1861
1862
1863
1864
1865
1866
1867
1868
1869
1870
1871
1872
1873
1874
1875
1876
1877
1878
1879
1880
1881
1882
1883
1884
1885
1886
1887
1888
1889
1890
1891
1892
1893
1894
1895
1896
1897
1898
1899
1900
1901
1902
1903
1904
1905
1906
1907
1908
1909
1910
1911
1912
1913
1914
1915
1916
1917
1918
1919
1920
1921
1922
1923
1924
1925
1926
1927
1928
1929
1930
1931
1932
1933
1934
1935
1936
1937
1938
1939
1940
1941
1942
1943
1944
1945
1946
1947
1948
1949
1950
1951
1952
1953
1954
1955
1956
1957
1958
1959
1960
1961
1962
1963
1964
1965
1966
1967
1968
1969
1970
1971
1972
1973
1974
1975
1976
1977
1978
1979
1980
1981
1982
1983
1984
1985
1986
1987
1988
1989
1990
1991
1992
1993
1994
1995
1996
1997
1998
1999
2000
2001
2002
2003
2004
2005
2006
2007
2008
2009
2010
2011
2012
2013
2014
2015
2016
2017
2018
2019
2020
2021
2022
2023
2024
2025
2026
2027
2028
2029
2030
2031
2032
2033
2034
2035
2036
2037
2038
2039
2040
2041
2042
2043
2044
2045
2046
2047
2048
2049
2050
2051
2052
2053
2054
2055
2056
2057
2058
2059
2060
2061
2062
2063
2064
2065
2066
2067
2068
2069
2070
2071
2072
2073
2074
2075
2076
2077
2078
2079
2080
2081
2082
2083
2084
2085
2086
2087
2088
2089
2090
2091
2092
2093
2094
2095
2096
2097
2098
2099
2100
2101
2102
2103
2104
2105
2106
2107
2108
2109
2110
2111
2112
2113
2114
2115
2116
2117
2118
2119
2120
2121
2122
2123
2124
2125
2126
2127
2128
2129
2130
2131
2132
2133
2134
2135
2136
2137
2138
2139
2140
2141
2142
2143
2144
2145
2146
2147
2148
2149
2150
2151
2152
2153
2154
2155
2156
2157
2158
2159
2160
2161
2162
2163
2164
2165
2166
2167
2168
2169
2170
2171
2172
2173
2174
2175
2176
2177
2178
2179
2180
2181
2182
2183
2184
2185
2186
2187
2188
2189
2190
2191
2192
2193
2194
2195
2196
2197
2198
2199
2200
2201
2202
2203
2204
2205
2206
2207
2208
2209

127

GM
UNIVERSITY
DEC 1 1917

31

SOME RESPONSES TO ENVIRONMENT IN MASSACHUSETTS.

MALCOLM KEIR,

ASSISTANT PROFESSOR OF INDUSTRY, UNIVERSITY OF PENNSYLVANIA.

The picture of Massachusetts to hold in mind is a rectangular state, mountainous in the west, hilly in the center and with lowlands in the east. Nestling between the western mountains—known as the Berkshires—lies the small narrow Berkshire valley, while shouldering aside the central hills is the broad valley of the Connecticut River, separating the hill region into a western and an eastern highland. The latter gives place to the eastern plateau, and this in its turn grades into the coastal plain, a depressed section of which at the head of Massachusetts Bay is called the Boston Basin. The Berkshires may be identified by the city of Pittsfield; the Connecticut Valley by Springfield, which stands as its doorway; the eastern highland by Worcester, the metropolis of all the central region; and the Plain and Basin by Boston; the center for the activities of all parts of the state adjacent to the sea.

Standing out from this physical background are two factors—one the prevailing direction of the hills and valleys, the other the visitation of the glacier—that have been of importance in controlling the destinies of the commonwealth. Our attention will first be directed to the fact that the hills and valleys which are such characteristic features of Massachusetts topography are not an unordered jumble of chaotic land forms but upon close scrutiny reveal that the common trend is from the north toward the south. This characteristic is most pronounced in western Massachusetts and least discernible in the east; accordingly there is no hard and fast line that separates the region where the north-south tendency of the hills and valleys is well marked, from that in which it can hardly be traced. Nevertheless, a line drawn from the point where the Merrimac enters Massachusetts, to the point where the Blackstone leaves the state, would, with a fair degree of accuracy, divide the commonwealth into

two parts, of which the western, comprising about two thirds the total land area, would be the portion that clearly portrays the peculiarity under discussion.

The effect of the direction of the hills and valleys is to shut off the portion of the state west of the Merrimac-Blackstone line from free communication with the coast region. The Connecticut Valley is an exception for it may be reached easily from the coastal plain by means of the Connecticut River. The conformity to rule, displayed by the topography and the consequent segregation of the eastern district is so easily stated and so readily recognizable that its significance may be overlooked and the consequences that arise from it either ignored or attributed to other causes; nevertheless, the parts of the state earliest settled, the present distribution of population, the routes of roads, canals and railways all have been swayed by this feature of the environment. Furthermore, manufacturing and agriculture have been moulded by the direction of their outlets, and even the variations in the type of summer visitors found in different parts of the state have been induced by the prevailing tendency for hills and valleys to cross the state from north to south.

Having passed over the ocean, the Pilgrims and Puritans found themselves in that portion of Massachusetts which is most free from hills. The pioneers encountered no natural difficulties when they established communities north or south of Plymouth and Boston, for the land parallel to the coast, although by no means perfectly flat, interposed no great obstructions across the path of travel, but on the contrary, offered gentle rises and broad shallow valleys easy to overcome. Even toward the west the country was open and comparatively level for a short distance, the present town of Framingham marking the edge of the favored district; but beyond this point the higher portions of the plateau were encountered, hills became more numerous and harder to climb until insensibly the highland region was reached. Within the highlands few streams cut pathways through the hill barriers and fewer valleys offered easy passage, therefore the "grain" of the country, so to speak, blocked travel toward the west, and held settlers on the coastal plain and lower plateau. As a consequence the early towns were strung along the shore or as far back from it as the coastal plain extended, but stopped short when the highlands were confronted.

When the harmony of the first towns was disrupted by dissen-

sions and the disgruntled or adventurous members of the little companies went forth to establish new homes it was ease of travel along the coastal plain that led them southward to Providence (R. I.) and

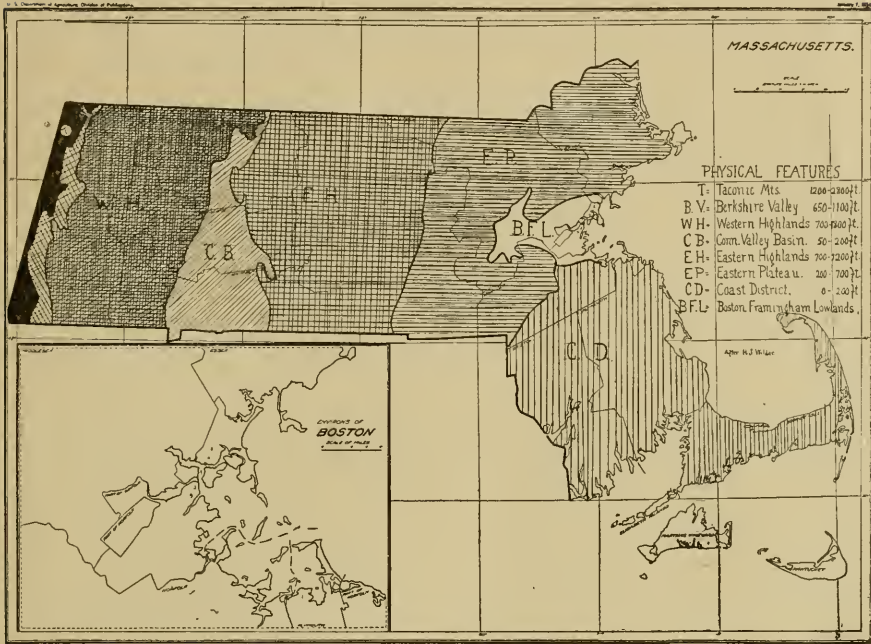


FIG. 1. THE PHYSICAL DIVISIONS OF MASSACHUSETTS.

Saybrook (Conn.). The Connecticut River, whose mouth was at Saybrook, lured settlers from that tiny outpost onward to the upper river valley, because the waterway afforded so advantageous a means of transportation and was the only easy route by which the interior could be reached. In 1631 William Pynchon, hailing from Cambridge, founded Springfield, the first settlement in the portion of the Connecticut Valley that lies within Massachusetts. All the expanse of the eastern highland and plateau, a land of infinite hills, separated the new village from the towns along the Atlantic, with the result that for a hundred and fifty years after its foundation there was no overland connection between Springfield and eastern Massachusetts, and the little fortification constituted the remote western frontier, a refuge for pioneers fleeing from war-crazed Indians and itself the

scene of redskin outrages. So little influence was exerted by the home government of Massachusetts at Boston over the distant colony, that the people sheltered by Pynchon's stockade affiliated themselves politically with Hooker's town of Hartford (Conn.) further down the Connecticut, and they very reluctantly withdrew this natural association to recognize the artificial political authority of the general court of Massachusetts, seated so far away at the head of Massachusetts Bay.

If the physical conditions had permitted, it is entirely probable that the first colonists would have penetrated the interior of the state, and set up solitary detached homesteads just as immigrants did in later years when the western prairies were opened. If such had been the actual event then the town economy so closely connected with the name Puritan could not have developed as strongly, and the state and nation would have been the losers thereby; furthermore, agriculture would have replaced commerce as the leading industry, since it would have been the only one possible, and the whole course of American history would have been altered. As it was, the innate predilection of Puritans toward town government was given full encouragement by the natural environment and the gregarious instinct was not only not thwarted by nature but actually abetted, for the people were held close together either along the coast or in the Connecticut Valley whereas the rest of the state remained detached, isolated and unpeopled.

Fear of the Indians might have brought about the same result when the colonies were first established, but this factor disappeared in a comparatively short time, so that a spreading out of population would have taken place if the natural checks had not kept it constrained. The power of the church in government matters also tended to create population centers, for a town could be incorporated as soon as a place of worship was built and a minister provided, and inasmuch as the compelling motive for emigration had been religion, the people desired churches as soon as their homes were erected. The church was such an important feature in a Puritan's life that it acted as a magnet in holding individuals within sound of the Sabbath bell. Notwithstanding this fact the church would have lost much of its power to bind men together if the topography had favored their drifting apart. The necessity for defense against a savage enemy, and the power of religion worked together with the influence

of land forms to produce a dense population on the Massachusetts coast, yet if the steadfast force of hills and valleys had been taken away the tendency for settlers to lose themselves in the all surrounding land could not have been prevented. Therefore we must attribute the early grouping of the population of Massachusetts to the rigors of the journey westward across the hills as contrasted with facility for movement in the littoral and river zones.

The massing of the population in the lowland and valley had a direct bearing upon the industries conducted within the commonwealth for it did not take long for the people, especially those near the coast, to discover that greater wealth could be drawn from a generous ocean than from a niggardly land, and that the harvests which furnished the largest profits were not the yields of fields garnered into barns, but fish, sugar, and molasses gathered into warehouses from the holds of sailing vessels. Commerce became the leading industry with fishing and shipbuilding as corollaries, a condition which was unchanged for two hundred years. Inasmuch as commerce is an urban business, the tendency away from rural life fostered by the topography was furthered by traffic, and coast towns increased in size. Hence the characteristic grouping of the population was maintained.

During the first half century after 1800 political and economic changes made commerce unprofitable, but the condition of settlement stimulated by this industry was of great benefit to manufacturing, and aided it to take first place in the affairs of the state. For instance, the Portuguese population of New Bedford, attracted to the city by the trade of whaling, went to work in the cotton mills as operatives, when the factories were erected; and the fishers' wives living in Marblehead and Salem, who had long bound shoes for Lynn "factors," followed the job into the shoe shops after machinery was adopted. In the Connecticut Valley when Springfield ceased being the point for the transshipment of water-borne cargoes, its strategic location made it a railroad center, so the people at the crossing point of the two principal travel routes—one north and south by the river, the other the land trail east and west—were not dispersed but augmented when locomotives replaced boats. The population assembled by the river and rail traffic proved an excellent nursery for the development of manufactures and made Springfield the home of factories of widely divergent types.

The great impediment to progress in manufacturing in the early history of the United States was the dearth of labor, but in Massachusetts the natural environment had long pressed the people into narrow confines, so that when manufacturing was an infant industry it could draw upon the army of labor already mustered in a few camps. Most auspiciously the first industry, commerce, wherein this body of labor had been enrolled as an escape from the natural restrictions of its environment, was on the decline just at the time when factory enterprisers were seeking employees. Hence the well-defined segregation of the inhabitants of Massachusetts has been

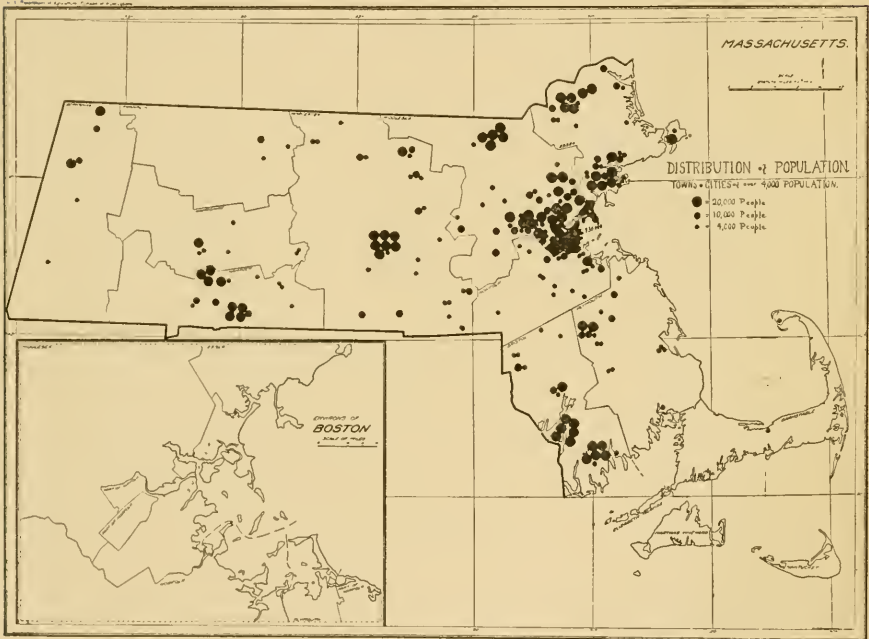


FIG. 2. DISTRIBUTION OF CITIES IN MASSACHUSETTS.

of immediate benefit to the two industries which have commanded the most attention in the state, and has been a potent though silent factor in bringing those industries into the foremost rank. The result is that the isolation of population in the east and along the Connecticut River first made necessary by topography has not only been preserved to our day, but actually made much more conspicu-

ous, for the industries have emphasized a condition which they did not create.

The present distribution of population follows closely the lines laid down by the original settlement, as may be shown by a study of the cities. The section of Massachusetts least under the influence of hills is the Boston basin, whose boundaries may be roughly designated by a circle fifteen miles in radius and drawn about Boston as a center. Within this area, movement is almost unhampered, hence from the earliest times down to our day, people have swarmed across this plain. Fifteen out of the thirty-three cities of the state, housing thirty-eight per cent. of the total population, are located within the basin; in other words, nearly two fifths of the men, women and children who live in Massachusetts are within sight of the gilded dome of the State House. As a result, Boston is the only one of the twenty-five largest places in the United States that has more people within ten miles of the city than within the metropolis itself.

The communities which surround Boston are not suburbs in the sense of being merely overflow dormitories for men whose business is in the capital,—as is so frequently the case elsewhere,—but on the contrary, each town has a distinct individuality of its own and a lineage almost as ancient as Boston itself. For example, Cambridge, founded in 1631, has a population exceeding that of Albany, Des Moines or Spokane, and its university sheds luster on its great neighbor across the Charles River. Lynn, incorporated in 1629, is larger than Troy and is the greatest shoe city in the world. Somerville¹ is greater than Savannah, Duluth, Norfolk, Utica or San Antonio. It is the abbatoir of Massachusetts, outranking all other places in the state in slaughtering and meat packing. Chelsea,² whose history dates from 1638, is prominent in the manufacture of rubber goods and shoes, while in Peabody, Salem (1629) and Woburn (1642) tanning and finishing leather predominate; so the list might be continued, each city distinguished in some one of the industries of the state and maintaining a high degree of personal difference despite their close proximity to each other and to Boston.

¹ Incorporated in 1842, therefore an exception so far as lineage is concerned.

² Population exceeds that of Jacksonville, Wichita, Galveston, Kalamazoo or Racine.

Next to Boston basin, the portion of Massachusetts that is least divided into narrow strips by hills is the lowland that parallels the ocean and extends back from it for about twenty miles. Outside of the basin, which of course is part of the lowland, there are nine cities in the coastal zone and into these places sixteen per cent. of the population is crowded. The physical features which kept Puritans near the shore are still operating to hold the people in check, for upon the lowland one may find more than half (54 per cent.) of all the persons who dwell in the state.

In all of highland Massachusetts there are but eight cities, notwithstanding that in territory this section comprises two thirds of the area of the state. The location of these communities points to the influence of the trend of the land, for seven³ are either at the heads of valleys and therefore the extreme limit for ingress to the interior from the south or at strategic situations where the few east-west valleys cross the north-south ones. In general the highland cities (containing 12 per cent. entire population) are smaller than those in the lowland, because they are more difficult of access. If the percentages of population represented by the thirty-three cities are totaled one comes upon the astonishing fact that two thirds of the human beings in Massachusetts live in an environment of paved streets and policemen. Since most of the inhabitants of the state nestle under the shadow of Boston and the remainder in cities widely separated from each other, it follows that much of Massachusetts is curiously empty, despite the fact that next to Rhode Island, Massachusetts has more people per square mile than any other state in the union. This anomalous condition has been brought about by the arrangement of the hills and valleys, for it first segregates the coastal district from the interior and then separates each group of inland cities from the others, exerting a quiet, powerful influence in determining which parts of the state shall be filled with people and what parts almost deserted.

What has been said in regard to the control topography has exercised over settlement from the time of landing of the Pilgrims down to our own day, may have foreshadowed what we have to tell concerning transportation; for both the distribution of the population and the routes of traffic have been under the same dominance.

³ The exception is Holyoke, created by water power.

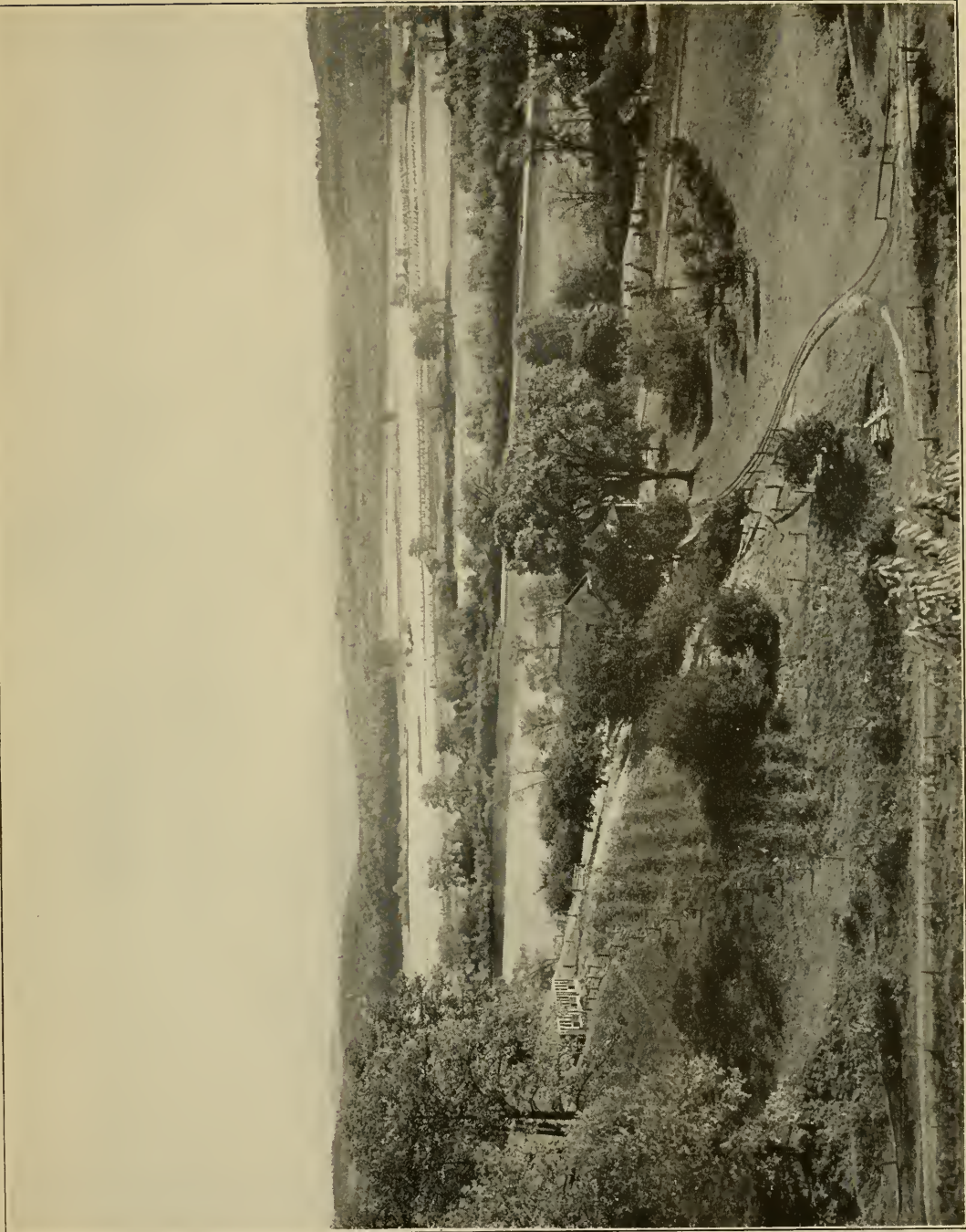


PLATE II. DEERFIELD VALLEY AT SOUTH DEERFIELD, MASS., NEAR ITS JUNCTION WITH THE CONNECTICUT VALLEY.



PLATE III. CATAMOUNT MOUNTAIN AND DEERFIELD RIVER, SHELBURNE FALLS, MASS. A typical scene in western Massachusetts that shows why roads follow river valleys.



PLATE IV. EAST PORTAL HOOSAC TUNNEL, BOSTON & MAINE RAILROAD,

The unequal apportionment of the low and high land in Massachusetts has given rise to two distinct types of transportation routes, the one associated with the maritime province, the other connected with the western hills, valleys and mountains. The Merrimac-Blackstone line which we have already defined marks a zone that is the division area between the lowland type of route and the highland.

Since the ease of travel upon the lowland produced a dense settlement within this restricted domain we would expect the earliest

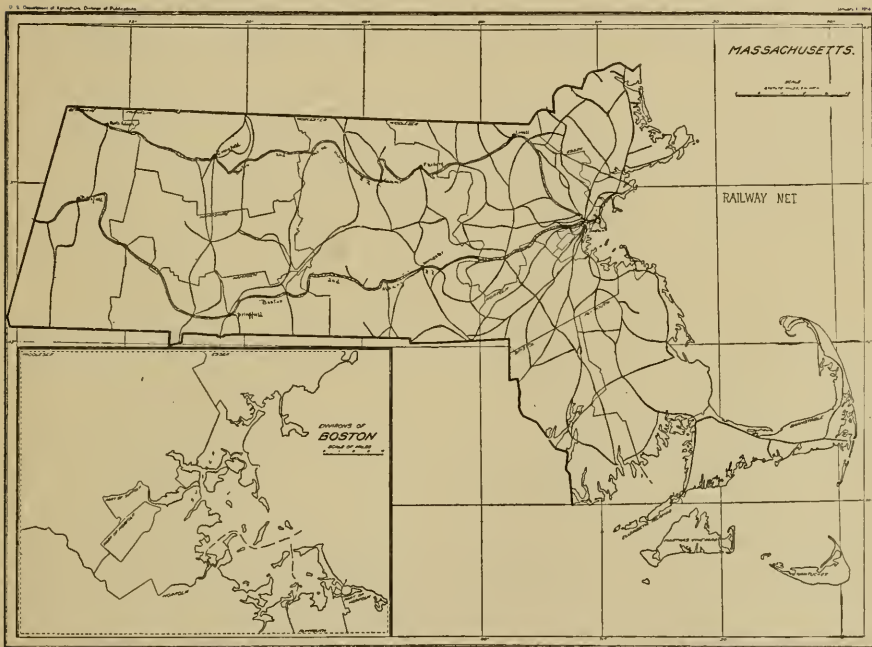


FIG. 3. THE RAILWAYS OF MASSACHUSETTS.

and most complete development of all forms of transportation to take place there. At a time when most communication between colonies was by means of boats and within nine years (1639) after its own foundation (1630) Boston was connected with Plymouth by a road overland. Weymouth, Concord, Salem, and Lynn were not slow to follow in the opening of roads, so that soon Boston became the center from which many routes radiated, and with succeeding

years the multiplication of villages, towns and cities but heightened the characteristic. Boston was selected by nature for this rôle because it is both at the middle of the lowland's sea border and at the head of Massachusetts Bay, while Salem, its early rival, is on the outer rim of each and Plymouth is entirely outside; the latter place suffered too in prestige because the soil back of its confines was too poor to be conducive to settlements. All roads, therefore, led to Boston and made it the metropolis for the entire coast district.

The northern position of Boston in respect to the other settlements along the Atlantic would naturally turn the main stream of outward travel in a southern direction, therefore it was but logical for the first stage coach line (1767) in Massachusetts to run between Boston and Providence. The usual method of incoming travellers was to proceed from southern points to Providence by boat and then continue their journey by land, using the stages that ran between the two northern cities, so as to avoid the tiresome and often dangerous voyage around Cape Cod. Gradually the stage routes were extended southward along the coast touching New Haven, New York and Philadelphia, so that eventually salt water travel could be avoided entirely if one so desired. It was almost twenty years after the first line along the coast was established that coaches overcame the trials of westward journeys from Boston toward the Connecticut River and thence southward, although this route later became famous on account of its shortness.

Roads and stage line appeared in the towns of the Massachusetts shore zone as early as any places in America, and likewise, about the beginning of the nineteenth century, when the canal fever burned so hotly in the United States, Massachusetts was one of the first states to charter this form of a waterway. Boston was joined to Lowell by the Middlesex Canal in 1808, in order to give an outlet for Lowell's rapidly growing cotton factories through the port of Boston. Compared with the Pennsylvania and Maryland canals the Middlesex was constructed with the greatest ease because the low plateau through which it was cut raised so few engineering problems, and also for the reason that the total length was twenty-seven miles, such a short distance between termini being a characteristic of routes confined to the Massachusetts coast area, since no two cities could be very far apart.

The Middlesex Canal, like most of the others built in the first flush of the craze for internal improvements, lost its prestige when a railroad paralleled its course (in 1835). The Boston and Lowell Railroad was one of three chartered and completed at about the same time, the Boston and Providence, and Boston and Worcester being the other two. Inasmuch as these roads ran north, west and south it is apparent that the tendency for all routes to *radiate* from Boston was not broken. The towns along the north shore were united to the metropolis by the Eastern Railroad laid down in 1838, thus adding one more spoke to the wheel that turns around Boston. Branch lines from these four principal outgoing routes reach every community in the coastal plain or plateau, and with the junctions formed between the main roads form a complex web of steel that binds all of the coast region to the capital city.

The work begun by steam railroads has been continued by street railways, starting in Boston in 1856. Horse car lines running from Boston to Charlestown, South Boston and Lynn began a process of consolidation which electric cars have completed, for all of the fifteen-mile circle of communities in the Boston basin are to all intents and purposes one single metropolitan area. Not only the towns and cities immediately adjacent to Boston are corded with electric transportation but even places so distant as Gloucester, Providence and Worcester.

The automobile truck is the latest conveyance transferring both passengers and goods from town to town; the service inaugurated by the railroads and extended by the electric lines is made intimate and complete by the trucks. The railroads touched one part of a town, trolleys came into the main streets, but trucks may go from house to house. Trucks are the latest most personal transportation factor in Massachusetts. With these three, locomotive, electric car and truck, no place in eastern Massachusetts can remain remote or isolated, whereas before their coming even Cambridge was a great distance from Boston.

Nowhere else in Massachusetts or in all New England can there be found a condition that duplicates the picture we have just sketched, because in no other portion of the state or in the group of states to which this one belongs is there such a lack of hills, mountains and valleys that men may build roads, canals and railways

where they will. The presence of hills to the west made people content to stay on the easily traversed strip of land near the Atlantic and gave rise to such a density of population that every mode of transportation was seized upon and speedily developed. The peculiarly favorable position of Boston, combining the advantage of a site most admirably adapted to communication by water, and a

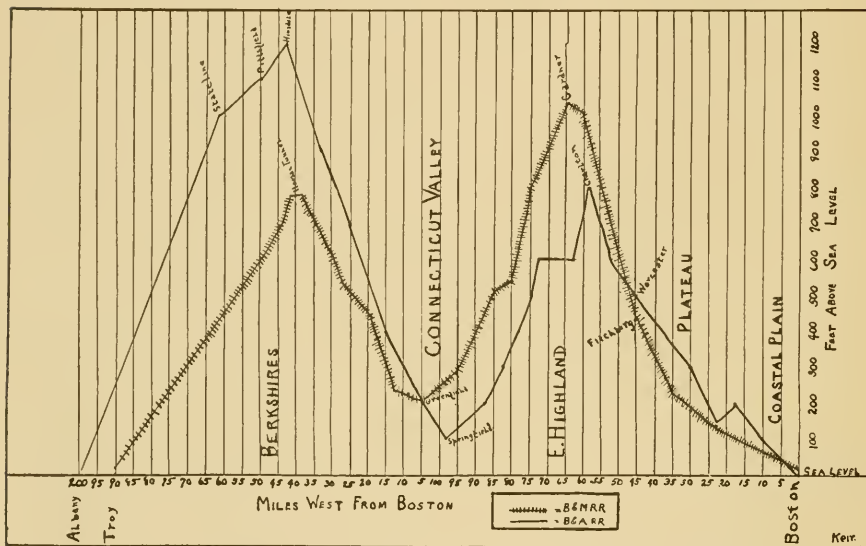


FIG. 4. PROFILES OF THE B. & A. AND B. & M. RAILROADS.

situation that gave it command over all land trails, forced it to become the focal point for all roads and conveyances.

If one crosses the line drawn between the Merrimac, at the northern boundary of the state, and the Blackstone on the southern, one is soon aware that transportation in the western section bears no resemblance to that across the line in the east, for there is no center toward which all roads run, but there are as many highway systems as there are valleys. The further west one goes the more independent and less related each valley system becomes, for the intervening hills are converted into barriers more and more difficult to cross, so that the usual routes of travel, instead of converging upon a particular point, run parallel to each other. In order to under-

stand the transportation of interior Massachusetts, therefore, one must know the disposition of the valleys.

The distribution of valleys in central Massachusetts gives rise to a picture which resembles a gigantic bug, of which the Connecticut forms the body, while the Deerfield and Millers River valleys constitute the forelegs and the Westfield and Chicopee valleys the hind-legs. The articulation of the right and left "limbs" is so symmetrical that these are of the greatest consequence in all transportation across the state, for roads like veins run along the "legs" and down both sides of the "body." These four east-west valleys are the only ones available for overland traffic, yet even these were neglected for a century and a half after settlements were made in the central and western parts of the state, because most of the pioneers who took up land came by way of the numerous valleys that opened from the south, the chief highway of course being the Connecticut River.

The first stage line to connect the east coast with the Connecticut Valley ran between Boston and Springfield and made use of the Chicopee route for the reason that, in all the welter of high land and low, this was the one course reasonably free from obstruction. Along this so-called "Boston Post Road" one traveled comfortably across the Boston basin to its edge at Framingham where one commenced the wearying journey up hill and down dale until the tiny valley gouged from the hills by the Seven Mile River permitted the coach to follow the trough instead of struggling over the crests. The Seven Mile runs into the Chicopee and the latter joins the Connecticut, but despite the fact that the valleys offered smoother going than the previous road across the ridges they were little better than gorges, so it was not until the Connecticut was reached that a jolting, rocking, bumping coach could settle into an even glide. Where there is little choice one must take what one can get, so these narrow, rough valleys had a high value, because there was no better route that wayfarers might select.

The Connecticut River and the Chicopee trail were the only valuable inland routes⁴ in Massachusetts until the state began canal con-

⁴ The value of the river as a highway is clearly proven by the repetition of names of towns. Thus Hanover, N. H., commemorates Hanover, Conn. Haverhill and Newbury, Vermont, are direct descendants of Massachusetts

struction. The places where canals were built and the effect they had upon the industrial life of Massachusetts clearly point to the influence of the trend of hills and valleys. The first attempts at canal operations were at falls in the Connecticut River, beginning in 1795 at what is now Holyoke and continuing until 1892, when the last rapids were looped by water detours. These canals gave the valley towns uninterrupted boat traffic to Long Island Sound and strengthened the bonds of trade between the valley and New York. A canal following the valley of the Farmington River was opened from Northampton above Springfield to New Haven (Connecticut), in order to give the Connecticut city a share in the valley trade. Worcester dug itself out of the enfolding hills by canalizing the Blackstone River so that her products could be shipped by barge through the port of Providence. This event marks the beginning of the rise of Worcester, for until that time (1828) it had been a struggling village of three thousand people isolated by its interior location. Given an outlet for the first time by the canals, which was enhanced later by railroad communication, it has grown to be the second largest city in the state. It is noticeable that none of these canals ran east and west, but all followed the general trend of the valleys in the other direction, and it is from this fact that the canals gained their greatest importance, for they were the direct cause for the introduction of railroads.

With the towns in the Connecticut Valley pouring their products into New Haven and New York, and with Worcester adding to the prestige of Providence, Boston felt that she was losing her title to supremacy and sought a remedy whereby she might be the gateway for the entire state. She first proposed to connect the Merrimac with the Connecticut and then cross the Berkshire Hills to the Hudson River, but this waterway, gigantic for its time, never got beyond mere talk, since canals were discarded in favor of railways. Boston turned attention to them as a salvation, for she hoped to divert the traffic of the Connecticut River towns and of Worcester to herself by a railroad across the state.

The Boston and Worcester Railroad, chartered in 1831 and towns of the same names. Other examples: In New Hampshire, Charlestown, Springfield and Concord. In Vermont, Springfield, Windsor and Newport.

opened four years later, was the product of Boston's scheme to overturn nature by artificial means. To make the whole width of the state contribute to Boston, the Western Railroad in 1839 continued the B. & W. to Springfield⁵ and then within two years more tapped the Hudson at Albany. Notwithstanding the fact that these railroads faced westward, contrary to the rule that traffic moves north and south in highland Massachusetts, nevertheless the engineers who surveyed the right of way could find no better path across the state than the rough one via the Chicopee, first utilized by stage coaches. Beyond Springfield the Westfield River gorge was the only practicable path, therefore the scarcity of east-west valleys has forced all traffic to flow through the few that do exist.

Not satisfied with one line that crosses only the southern part of the state, a second road, the Boston and Maine (1836), was pushed across northern Massachusetts, and the difficulties it met well illustrate the influence of land forms on travel.

This railroad ran out of Boston by a circuitous route to Fitchburg; beyond that city it was forced to travel around a long loop in order to climb to the top of the eastern highland which it crossed to Gardner. From Gardner it searched out the narrow valley of Millers River and followed it to the Connecticut Valley. At that point the westward reaching valley of Deerfield invited further travel, but at the headwaters of the Deerfield there towered the ridges of the Hoosac Mountain Range. Across the mountains at North Adams, there was a river valley (the Hoosic) pointing in the right direction for the railroad but the range was in between. For twenty years the railroad was halted while a tunnel was being pushed through the five miles of mountain mass, and to open the passage cost sixteen million dollars. From Fitchburg (Mass.) to Troy (N. Y.), the Boston & Maine has been under the heavy handicap of overcoming natural obstacles, because it runs contrary to the lines laid down by topography.

Long before this second east-west line was established, junctions were made by the towns upon the Boston & Albany with the railroads that crossed Connecticut and Rhode Island. Thus Springfield was connected with Hartford in 1844 and later to New Haven and New York, the road eventually becoming part of the New Haven

⁵ The roads were later consolidated under the name Boston & Albany.

Railroad system. As an outlet for Springfield it followed the natural line of the river valley, the route to which the city had long been accustomed, so it has proved of greater importance to the valley metropolis than the connection eastward to Boston. The accompanying list of river valleys and railroads proves that the tendency to use the natural travel routes was not confined to one valley and one railroad but was general.

River Valleys.	Northern Terminus.	Railroads, Southern Terminus.
Farmington and Quinipiac.	Northampton (Mass.).	New Haven (Conn.).
Willimantic and Shetucket.		New London (Conn.).
Quinnebaug.....	Southbridge (Mass.).	Norwich (Conn.).
Blackstone	Worcester (Mass.).	Providence (R. I.).
Housatonic	Pittsfield (Mass.).	Norwalk (Conn.).

Everyone of these railroads extended in the general north-south direction and coincided with the long used systems of highways that bound central and western Massachusetts to the states on the south rather than to Lowland Massachusetts to the east.

Since 1850 the state has been covered with the lines shown on the map, so that no part is far removed from a railroad, yet a close inspection will reveal that the apparent confusion of routes actually clings to the rules laid down by the first roads, for even today there are but two trunk lines westward, and all the branches from them run north or south. It is only around Boston in the comparatively low lying and almost level land that the word "web" applies, while to the rest of the state "stripes" would be a more fitting term, the "stripes" being vertical between two horizontal bands.

A study of the electric roads would disclose a case closely analogous to that of the steam lines, for the initial roads ran along the valleys, and are making east-west connection only now. The few that do cross the state east and west parallel the railroads and follow the well-worn paths in the Westfield and Chicopee River valleys.

The automobile routes, furthermore, that are listed in the Blue Books and outlined on the maps show forth the oft-repeated characteristics. We may make the generalization, therefore, that all travel in highland Massachusetts tends to run north and south by parallel lines following the trend of the hills and valleys, in direct



PLATE V. THE HOOSICK VALLEY.

contradiction to the system in the coast area, where travel all converges upon one point because there physical conditions not only permit but also encourage it.

The situation for the Highlands, that we have outlined, has a profound influence on the business relations of the commonwealth, for the commercial ties that are strongest connect western and central Massachusetts with New York, Connecticut and Rhode Island, rather than with Boston.

The direction of the Connecticut Valley which, as we have said before, formed the natural outlet for Springfield was southward; therefore, Hartford, New Haven and New York were more closely bound to Springfield by tradition, transportation and trade than that city's own eastern sister towns. The Berkshire Valley, reached from the south by the Housatonic River, whose mouth is on Long Island Sound near Bridgeport, Conn., has had a history similar to the Connecticut Valley and even a large part of its land is owned by citizens of New York City. The result is that western Massachusetts today feels independent of its eastern capital because its business relations, its summer visitors, and its main arteries of travel are all from the south, following the trend of the land. Boston is the hub of the coastal region of all New England but its outer rim falls far short of reaching its own western co-cities.

Furthermore a similar story could be told of most towns between Springfield and Worcester. There is nothing to hinder the spreading of the influence of Boston throughout the coastal plain and the eastern plateau, but the highlands to the west offer a bar in that direction, so it may be said that business relations with Boston and the attitude of regarding that city as a Mecca ceases at Worcester (the corresponding point in Connecticut is Stonington), beyond which point the Boston influence is highly diluted. Boston feared that canals would lessen her importance so she endorsed all railroad promotions for the purpose of strengthening her dominance; that her hopes have been most largely realized in the coastal region is due to no fault of hers, but to the trend of the high land across the pathways that lead to Boston. We are accustomed to hear Boston spoken of as the "Hub of New England" but as a matter of fact that is not strictly true, for she is the hub of the coastal area, only. Inland towns of Vermont and New Hampshire, just as the interior

section of Massachusetts, turn toward the south for commercial affiliations, because southern cities are more easily reached than Boston on the east. If one realizes that two thirds of Massachusetts lies in the highland and mountain sections one can conceive how significant it is that these areas are shut off from eastern Massachusetts.

Not only have transportation routes and the distribution of population been vitally affected by the characteristic direction of the land forms but the industries of the state also have felt the moulding influence of their surroundings; particularly is this true in respect to manufactures, agriculture and the "summer vacation business."

SOME RESPONSES TO ENVIRONMENT IN MASSACHUSETTS.

MALCOLM KEIR,

ASSISTANT PROFESSOR OF INDUSTRY, UNIVERSITY OF PENNSYLVANIA.

(Continued from the July Bulletin.)

The most marked attribute of Massachusetts' chief industry—manufacturing—is the degree to which various types are segregated or “localized”—to use the economic term. The textile industry, which is the greatest one in the state and in whose parts Massachusetts leads the nation, shows a marked tendency to cling to a few places. The cotton mills are for the most part in four localities, namely: on the southeast bays, the Merrimac and Connecticut rivers and the Blackstone; the wool mills are gathered together on the small streams of the eastern highland; the shoe factories cling to the Boston lowland and eastern plateau; and the writing paper plants are concentrated in the Connecticut Valley. A similar confinement to a narrow region is true of the jewelry, whip, horn-goods, chair, tanning and optical industries. We can not attribute this high degree of localization to physical causes entirely, for that is by no means true, yet the isolation caused by the trend of the valleys has been a very large factor contributing to the result. Most industries spread from one center by imitation, so it is quite natural that the communities within easy reach from the originating town should be the ones most likely to copy a successful enterprise, for the towns in the next valley, though near at hand geographically, are far away socially and industrially because the lines of communication are opposed to free interchange. We find, therefore, that the same industry is repeated in nearly every town in the same valley, even when that valley crosses two states, whereas the next valley, to the east or west, will be occupied by a different set of factories. As examples, the Quinnebaug and Thames Valley are full of woollen mills from Southbridge, Mass., to Norwich, Conn., but, on the other hand, the next large valley to the west, the Connecticut, is just as characteristically a paper center. To clinch the matter yet closer, we

have but to point to the fact that the capitalists who founded Lowell created Lawrence also, both towns in the same Merrimac River Valley, but it was Hartford money that built Holyoke,⁶ although Lawrence and Holyoke were started about the same time and for the same manufacturing industry, namely cotton. As a consequence, the localization of industry is more characteristic of Massachusetts than any other state, a condition which is not due to economic causes entirely, but is partly based on the separation of each little section of Massachusetts from all the other parts of the state.

Agriculture too, as well as manufacturing, shows the segregating effect exerted by the topography, for the type of farming conducted in any one particular place is largely determined by the market and this in turn is influenced by routes of travel. The best market in Massachusetts is found in the Boston basin with its teeming cities crowded close together, but this Mecca for food producers is shut off from most of Massachusetts so that even where soil and distance would permit the growth of truck crops they are not the rule, because it is too difficult to haul them to the point of consumption. It is only upon the Boston lowland, coastal plain and lower portion of the eastern plateau, all within the region devoid of great hills, that truck crops predominate. The Connecticut Valley is an exception to this rule, for gardens fill all the space not taken up by manufacturing cities and towns. Of course, all truck gardening must be conducted within a reasonable distance of its market, but the area for Boston in hill-bound Massachusetts is about half that for Philadelphia from across level New Jersey.

The greatest agricultural activity in Massachusetts is dairying and it is remarkably distributed over the whole state, yet—the crowning point of all in reference to the influence of the trend of the valleys and hills upon agriculture—despite the overwhelming predominance of dairying among the farming activities of the state, the cities surrounding Boston have found it advantageous to draw milk from the Rhode Island and Connecticut farms to the south, and from Maine and even Canada to the north rather than from the highland sections within their own domains to the west; although these places outside the state have no special natural superiority. Knowledge of this condition makes Massachusetts dairymen very

⁶ Both Hartford, Conn., and Holyoke, Mass., are in the Connecticut River Valley.

angry and they attribute it entirely to unfair railway rates, but they will have to remove the hills before the situation can be completely cured.

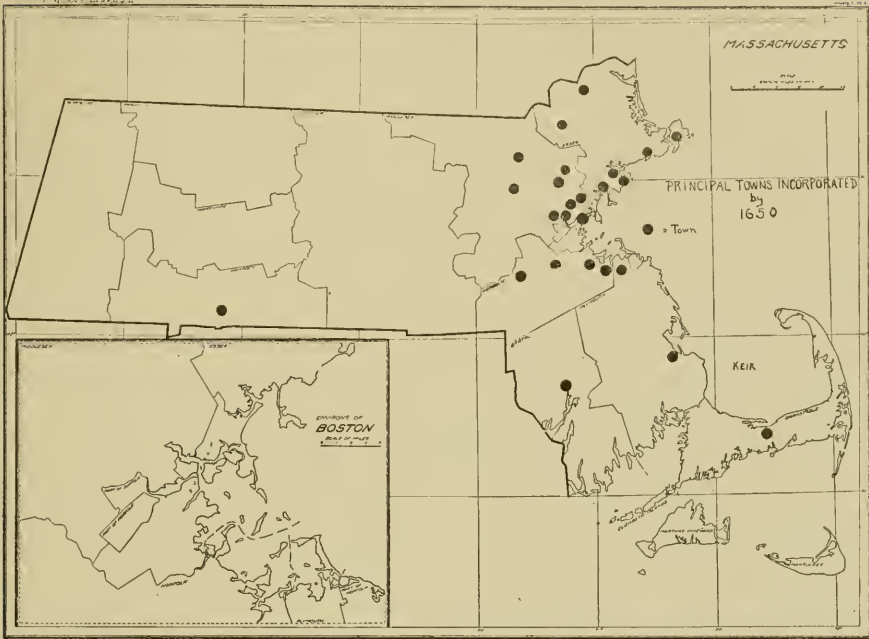


FIG. 5. PRINCIPAL TOWNS INCORPORATED BY 1650.

Similar to the segregating of manufactures and crops there is a differentiation in the type of summer visitors found in the various sections of Massachusetts. We are not accustomed to think of vacationers as forming an "industry," yet to all of New England the entertainment of people upon a holiday is of no mean importance, for it is estimated that fifteen to twenty million dollars is the annual "harvest" to these states from this occupation. In the Berkshires, in the central highlands and in the numerous shore resorts, Massachusetts takes a goodly toll from those who come to enjoy her natural advantages. The curious aspect of this summer traffic is that in no two parts of the state does one meet people from the same home cities, but each section has its own individual clientele. The well-to-do east-coast people spend the summer along the North Shore

or go still further north into Maine and Canada, while the less wealthy people seek the beaches along the South Shore. Very few either of the rich or the poor travel westward in their own state. On the farms of the highlands the visitors come from the towns to the south in Connecticut, while the city people of the Connecticut Valley flock southward to the shore resorts along the border of the Long Island Sound. The Berkshire hills and valley are the seat of estates belonging to wealthy people from New York and a few from Connecticut. The double-track express train service to the Berkshires runs northward from New York and not westward from Boston.⁷ In almost every case the summer population travels north or south. You may choose your social environment for the summer by a nice selection of physical environment, for the valley you elect will determine the people you meet.

By a little reflection over what has been stated, it is easy to perceive that the topography of Massachusetts greatly alters the currents of life within the state, although there are few insurmountable barriers. It has affected the earliest settlements and the present distribution of population, and furthermore caused a segregation in manufacturing projects, in agricultural activities and even in the persons attracted to the state upon pleasure bent. This feature of the physical environment therefore is worthy of attention.

A no less important phase of the natural surroundings in Massachusetts is the effect produced upon the lives and occupations of the people by the one-time visitation of the glacier, the most important and far-reaching event in the geological history of the state. By forming numerous water-power sites, made excellent by reservoir lakes, the glacier was directly responsible for the later growth of manufacturing in Massachusetts; by distorting the soil, the ice sheet set in motion those forces which have made agriculture in the state of so little importance; and by removing the overburden of rock the passage of the northern invader brought to light the underlying stores of granite, the chief rock resource of the present commonwealth; therefore, manufacturing, agriculture and quarrying, the three great industries of the present, have grown out of conditions produced in this one geological era of the past.

⁷ North Adams on the Boston and Maine and Pittsfield on the Boston and Albany are the only towns having *direct* connection with Boston, while every town in the Berkshire Valley is on the direct line to New York City.

Wherever the ancient rivers were obstructed by glacial material, they were forced to find new paths around the blocked passageway and in making the detour often flowed over uncut ledges; the power at falls thus created has been a source of wealth that is difficult to estimate because the hundreds of small places made available for manufacturing proved a boon to the earliest experimenters in factory enterprises and helped to establish manufacturing as the foremost

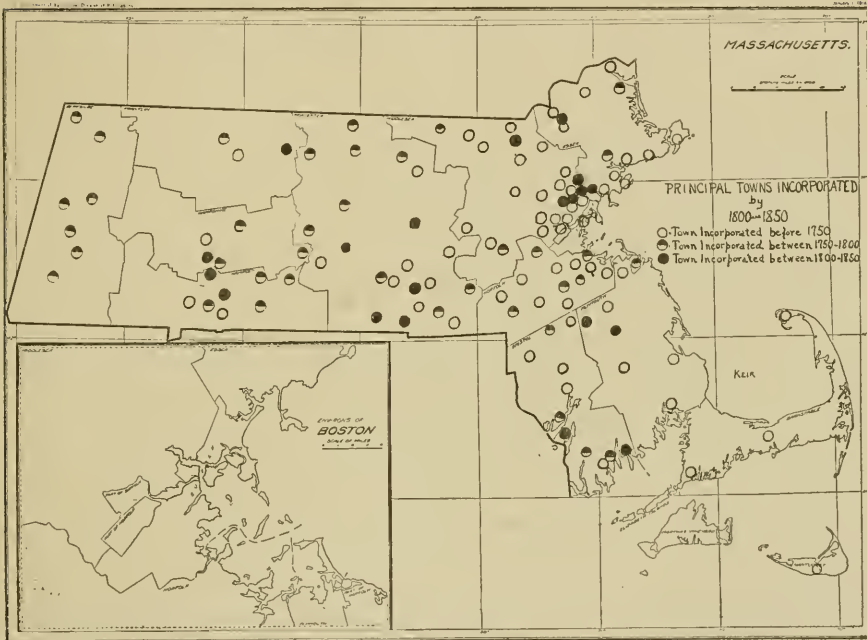


FIG. 6. PRINCIPAL TOWNS INCORPORATED BY 1800 AND 1850.

industry of Massachusetts. All of the brooks and small streams of the state are full of falls and reach the large rivers through narrow canyons, both of which conditions favored their early development, for the reason that small streams were easier to control than large rivers and the canyons readily accommodated themselves to dams and reservoirs.

Waterfalls are useless for power purposes unless the stream flow is maintained with a high degree of uniformity throughout the year and here again the glacier aided the future commonwealth, for not

only did the ice sheet produce falls but also made natural reservoirs wherein flood waters were stored and streams regulated during the dry season. After the main body of ice left the land, there remained in hollows and deep valleys blocks of ice which, slowly rotting, left depressions that formed lakes. In the course of time some of these lakes have been partially filled by vegetation and are now swamps.

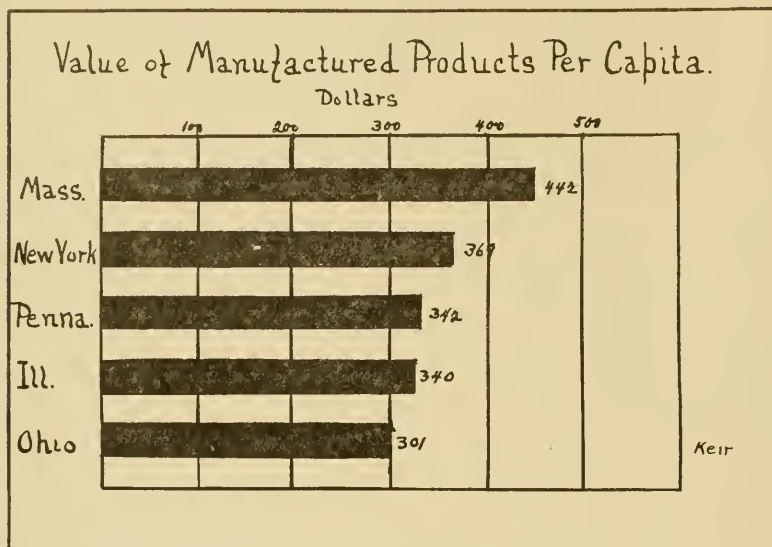


FIG. 7. VALUE OF MANUFACTURED PRODUCTS PER CAPITA.

Both the lakes and swamps perform the same function of accommodating floods and holding back the water so as to bring about a more uniform flow in the stream. It is the *combination* of falls, and regularity in the volume of water, that makes a site valuable for power, and since the glacier endowed Massachusetts with both of these advantages, it enabled her to lead the way in the development of manufactures.

Naturally the most falls were in the highlands and mountains of Massachusetts and when about 1750 water power commenced to be utilized for small mills, a deflection of population from the coastal plain and plateau took place, so that almost all of the present towns of importance in the inland territory began their history between 1750 and 1825. For the first time the domain remote from salt

water assumed an importance in the eyes of the progressive young men in Massachusetts; a new resource was spread before their gaze. Mill after mill was set up, and towns consequently appeared where previously lonely farmers had led sequestered lives. The "Father of the Cotton Industry," Samuel Slater, whose first factory was at Pawtucket, R. I. (1790), followed the Blackstone River back into Massachusetts and established a new project in that part of Oxford that is now Webster. The whole Blackstone Valley from Worcester to Providence became virtually one continuous mill village, and similarly the Quinnebaug River from its diminutive sources above Southbridge southward to Norwich, Connecticut, clattered with the activity of wool mills. The Chicopee, the Westfield, and especially the small branches of all the streams named, took on an importance that hitherto had been utterly foreign to them. In this manner and for the purpose of developing the water resources, inland Massachusetts was settled and transformed to a region of potential consequence. To the citizen of 1812 who saw commerce paralyzed, and the promise of a rapid rise in the importance of manufacturing, it must have seemed that the long neglected interior of the state would soon threaten the sovereignty of the shore zone, for the man of that time could not have foretold the limitations that progress in machines would place upon the water power of the state; he could not have predicted that looms and spinning frames would grow so large and heavy that the power of many of the small streams would be inadequate. The era of water power helped to distribute the population over a wider area and bring into usefulness a great proportion of the territory of the state, and in its heyday the textile industry became largely fixed as an inland business. If the invention of textile machinery had come *after* the successful application of steam engines to factory needs instead of *before* it, central Massachusetts would never have been much more than a summer resort. How true this statement is may be gauged by the shoe industry in which the industrial revolution did not take place until after 1850, with the result that it has always hugged the shore. If this business had been put upon a machine basis at the time when cotton was wrested from hand labor, it inevitably would have been moved inland⁸ upon

⁸ There is a tendency on foot at present for shoe factories to move inland to textile centers, but this is due to the exactions of labor upon the coast and the effort of manufacturers to escape to a town where their shops will be

power sites, and the momentum of an early start would have kept it there. Fall River and New Bedford, located upon the coast and using coal for power, illustrate what would have happened to the majority of cotton mills if they had succeeded rather than preceded the steam engine. We must attribute the expansion of inland Massachusetts to its resource of glacially derived water power and consider it fortunate that its factories became firmly rooted before coal was used for power purposes.

The earliest attempts at manufacturing were upon an exceedingly simple scale, hence unbelievably tiny streams could be utilized for power. For example, the story is told that at Southbridge upon a branch of the Quinnebaug River, the manufacturer whose little shop has grown into the great American Optical Company was accustomed to employ a horse to furnish power when the brook ran dry in summer; and at one time a lusty negro was hired at ten cents an hour to turn the wheels. Power requirements so small as this did not necessitate large streams; therefore, wherever a brook flowed there a shop might be found, and the glacier had left the state a legacy of innumerable such waterways. Fire, flood and failure wiped out many of the experiments in manufacturing and only a gaunt, naked water wheel on a broken raceway marks the scene of former activity; but not all the early attempts came to an end so evil, for many of the first little shops have grown into great plants, such as the American Optical Company just mentioned. The chief importance of the numerous little falls is that they encouraged so many men to try their fortunes in factory enterprises out of which the fittest have survived and placed Massachusetts at the head of American manufacturing states.

The age of small-scale operation did not last long, especially in Massachusetts' greatest industry, cotton cloth production, because improvements in machinery were made so rapidly and spinning frames and looms became so much larger and heavier that the small water powers were utterly inadequate to drive the belts and turn the shafts; hence cotton manufacturing concentrated upon the large rivers. A case in point is furnished by the Boston Manufacturing Company, whose first mill at Waltham, built in 1813, was the earliest the most prized work places because their wages are higher than in a cotton or woolen mill.

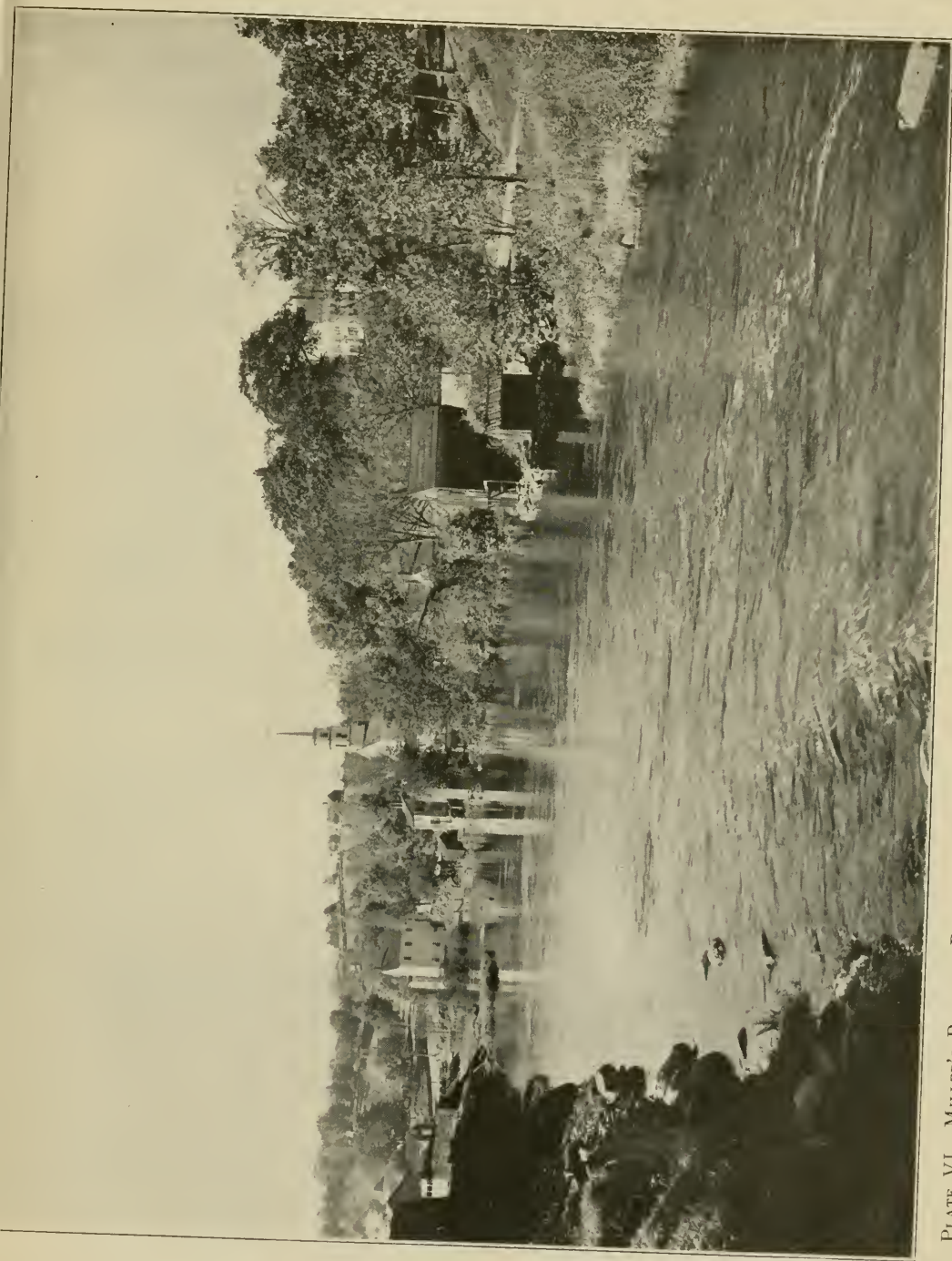


PLATE VI. MILLER'S RIVER AT ROYALSTON, MASS. A typical Massachusetts village scene. Note the farm houses on the hills.
Courtesy of Boston and Maine Railroad.

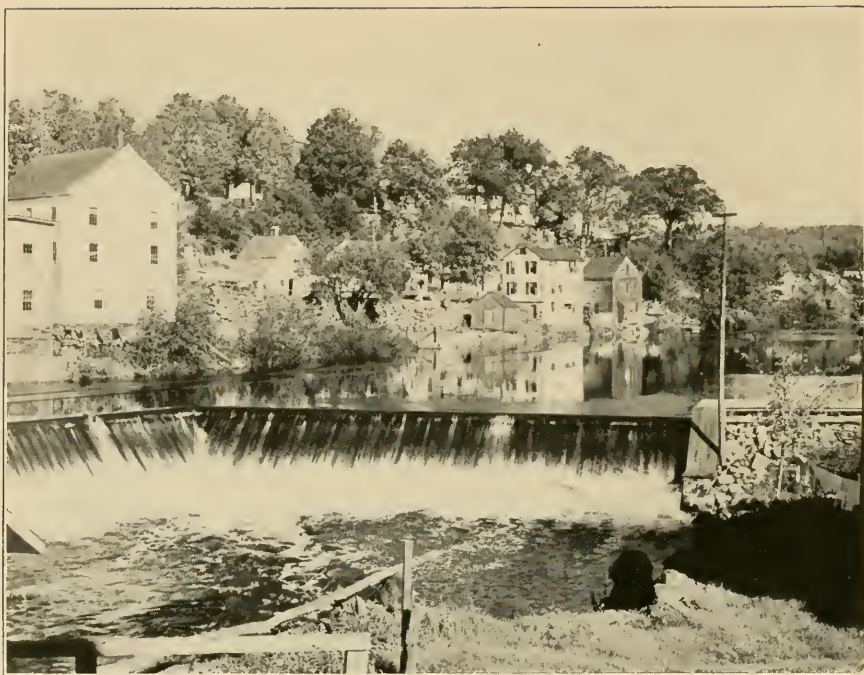


PLATE VII. MILLER'S RIVER AT ROYALSTON, MASS. One of the many small power sites in Central Massachusetts. Courtesy of Boston and Maine Railroad.

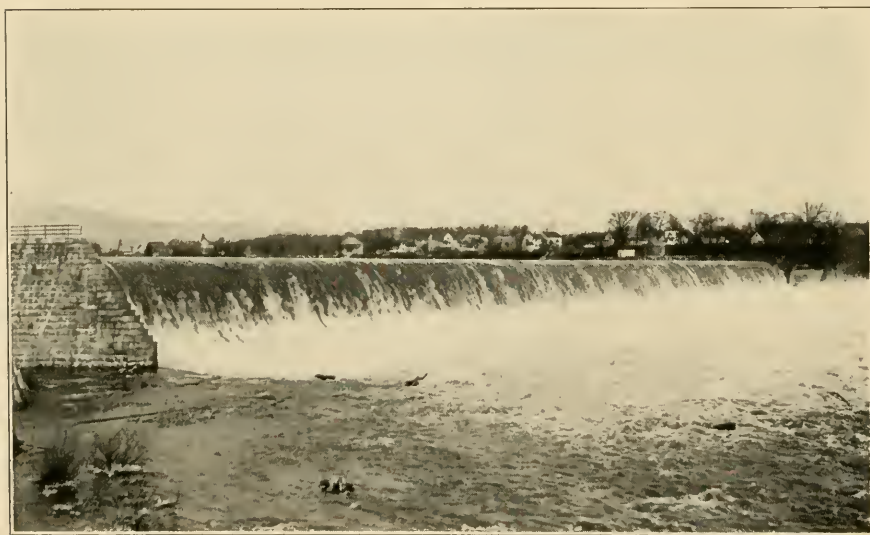


PLATE VIII. THE "MILLION DOLLAR DAM" AT HOLYOKE, ON THE CONNECTICUT RIVER. Courtesy Holyoke Water Power Co.

complete cotton factory in America, but which by 1825 was incapable of expanding to fit the enlarged requirements of the business because the stream was too small. The company bought a site on the Merrimac, at a point where it drops thirty-two feet, and brings to the use of man 30,000 horsepower, so that next to Holyoke it is the most valuable power in New England; there (in 1826) out of the woods the town of Lowell was brought to life. By 1850 Lowell had a population of 33,000 and was exceeded in size only by Boston.⁹ Along the banks of its power canals there were thirty-three mills, but since there seemed to be no possibility of additional expansion, the group of men in control went further down the Merrimac and selected the location¹⁰ for a new village where Lawrence now stands. That city at present contains the largest woolen mills in the world.

At about the same time as the inception of Lawrence, plans were matured to erect on the Connecticut River within the confines of present-day Holyoke, a city which would be a second Lowell. In furtherance of this object a dam was built across the state's greatest river and when completed the Lyman Mills were established on the power site thus brought into use. Therefore, as the cotton industry grew, the wealth of small power sites was neglected and the few of the first magnitude developed, but large as well as small powers were a heritage of the glacier.

A similar advance from small streams to a great river is shown by the paper industry of the state. In the Berkshire Valley, where some of the first attempts to manufacture paper had been made, mills became a most familiar sight, for between 1800 and 1850 twenty-seven paper-producing plants were built there. The town of Lee seemed in a fair way toward becoming a paper center of great importance, for there were no less than eighteen mills within its boundaries. However a change in paper manufacture took place which robbed Lee of most of its glory. The mills of which those at Lee were a type used but small amounts of power to reduce rags to a pulp. Frequently the Lee papermakers formed the sheets by hand, for even the small crude, easily operated machines often were

⁹ To-day Worcester is the second largest city of the state.

¹⁰ Develops 11,900 horsepower at 26-foot fall.

not installed for this second division¹¹ of papermaking. A revolution was started when Foudrinier (1803) invented a machine that turned out a large amount of paper continuously, for this machine necessitated a great deal of power to keep it running. The machine alone took up as much room as a whole mill did previous to its invention. Furthermore, the machine called for a much enhanced amount of pulp, so that the pulp grinders were necessarily increased in capacity and consequently demanded more power to operate. The Foudrinier machine therefore paved the way for large-scale production, and made cheap power a crucial factor. The greatest water power in the state was established when the Holyoke dam was constructed, so the largest paper mills were built along the canals that cross the city, and it became the greatest writing-paper center in the country. There are a few famous mills in the Berkshire Valley—, for example, the Z. and W. M. Crane, Old Berkshire Mills, the Pioneer Mills and the Government Mills, in which latter our paper for money is produced—, but despite these noted exceptions the supremacy in high-grade papermaking rests with Holyoke and is founded on cheap power. Glacial action turned the Connecticut River from its true course at that point and in endeavoring to get back to its former path the river has cut across intervening ledges and falls seventy feet in two miles. The volume of the river is so great that this fall created 40,000 horsepower, a figure unsurpassed in New England. The influence of abundant cheap power changed the headship of the paper industry from ancient Lee to upstart Holyoke.

The paper industry, as well as the cotton, shows that first the small then the large powers enabled manufacturing to get a firm hold upon Massachusetts, and inasmuch as manufacturing is the greatest wealth-producer in the state and the products have made the state famous throughout the nation, the glacier has had no small share in shaping the destinies of the commonwealth and influencing the lives of the people.

To the glacier also must be credited Massachusetts' poor showing in agriculture, for the ice mixed transported boulders, gravel and sand so thoroughly with the soils formed in place that there is

¹¹ Paper manufacture has three divisions: (1) Reduction of raw material to pulp; (2) sheets, single or continuous, formed from pulp; (3) finishing.

hardly a farm where the nature of the ground to be worked is uniform. During the era of agricultural self-sufficiency the variegated types of soil were not a detriment, for they permitted one farm to produce the many things needed by the isolated households; but in modern times with farming specialized by competitive money crops, the man whose holdings of land are not fairly uniform cannot hope to be successful in large-scale production. Inasmuch as American agriculture since the opening of the Erie Canal has been distinguished by its extensive rather than its intensive character it may be seen how handicapped the farmers of Massachusetts have been by the marked inequality of the soils with which they labored.

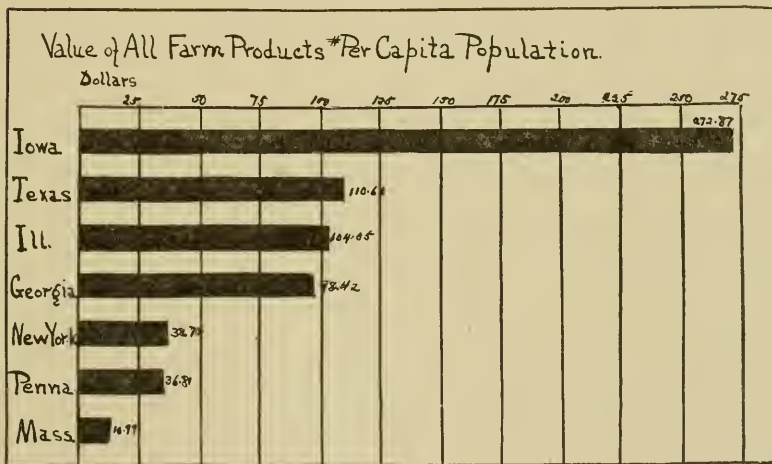


FIG. 8. THE INSIGNIFICANCE OF AGRICULTURE IN MASSACHUSETTS.

The multiplicity of soil types on one farm aggravates another peculiarity of glacial drift, namely its lack of immediate fertility. Soils of this character will endure for an indefinite period, because the rock breaks up and sets free the chemicals needed for fertilizing elements, but compared to virgin prairie they seem lean and miserly. Since the farmers, like other business men, are less concerned with the condition that will confront their grandsons than they are with getting the greatest return for their own labor, glacial soils cannot compete with the prairies; hence when they are brought into rivalry,

the soils that will last the longest are abandoned in favor of those which give wealth the quickest. There is no large area of Massachusetts free from glacial drift, therefore, her agriculture sank to a comparatively low level when forced to contest with the deep, extensive, rich soils of western states. Only seven per cent. of the people dwell in rural surroundings and crops valued at \$10.99 per capita¹² are insignificant sources of wealth compared to manufactures that are worth \$442 per person. Of the five greatest manufacturing states, Massachusetts devotes the smallest share of her energies toward farming.

Not only have the niggardly soils been forced to compete with more generous ones elsewhere, but right at home they have had to meet rivals more potent—the factories—which, as we have shown, were set up in nearly every stream valley at places where the glacier had forced the waterway into new channels. The ice sheet, therefore, made manufacturing easy, but heightened the ordinary difficulties of farming. The close propinquity of easy work in mills with unremitting labor on the farm spelled doom to the farm. If all the manufacturing plants in the state had been way off “down east” farm lads would have dreamed about them, but their lure would have been lessened by distance; as it was, the boy heard the factory whistle in the nearby valley when he ploughed.¹³ Since the glacier was responsible for placing the factory within sight of the farm, and at the same time made farming an arduous, profitless task, we may safely attribute to its visitation the relative positions of the two industries, with manufacturing far in the lead and agriculture trailing ignobly in the rear.

Dairying, the one great agricultural activity common to all parts of the state, is the direct outcome of the two factors outlined above. Soil poorly adapted to extensive farming; and populous centers growing in the valleys at points where glacial drift caused a change of current, creating water power and consequently manufacturing; these are the two principal forces that have placed cow culture in the forefront of Massachusetts agriculture.

With few exceptions all the soils surveyed in the state have proved more admirably suited to grass than any other product, so

¹² Per capita means whole population, not per capita rural population.

¹³ See illustration, Plate VI, page 174.

it is only the expected result that hay is the greatest crop, for even precipitous fields, too steep to permit any cultivation, may be devoted to grass and utilized as permanent pastures. Consequently the most familiar sights in Massachusetts are bursting hay wagons or rocky hillsides dotted with grazing milch cattle. In a region of such miserly soil as this, dairying is the logical industry, because it exerts the least drain upon the land. Crops which require a large amount of plant food would soon bankrupt the ground, but dairying raises the quality of the soil because so much fertilizing matter is returned to the meadows and pastures; therefore milk production is the industry most consistent with the environment of Massachusetts, provided a market can be found.

It is upon this latter score that the glacial water-power sites have supplemented glacial soils in bringing about the preëminence of dairying, for nowhere else in our country is there a state where so great a proportion of the people is separated from the land and creates such a demand for milk and butter. Ninety-three per cent. of the population lives in towns larger than twenty-five hundred, and seventy-five per cent. in cities of more than ten thousand population. Since this unparalleled market increases in size yearly, and inasmuch as cows may be raised wherever grass will grow, and considering that grass is the crop best adjusted to the soil of Massachusetts, the prevalence of dairying in the state is easily interpreted.

Notwithstanding the fact that the glacial period was so unkind to Massachusetts agriculture in most respects, it did confer benefits, however, upon the farming of certain particular parts of the state, notably the Connecticut Valley and Cape Cod.

The great gash cut across the state by the Connecticut River is the richest agricultural region in Massachusetts and the most unique, for the falling waters of the glacial lake formed by a natural dam below Hartford left terraces along the valley that mark the various levels at which the lake paused in its retreat. These terraces are composed of silt gathered from the whole Connecticut watershed and carried by the stream to the lake where the check offered to the current caused the water to drop the finest particles at the borders of the lake, and the coarsest nearest the channel. The resultant soil is the best that can be found in the state, and the easiest to work. The variation, however, between the terraces and the borders of the present river gives rise to a segregation of crops.

Along the terraces tobacco has been the leading crop since 1802 when the wife of a Windsor farmer made the first cigar to be produced in the Connecticut Valley. Tobacco is most exhausting to the land, therefore only the rich, deep level soil of the terraces is devoted to the crop. On the meadow lands bordering the river the leaf is too dark, heavy and low grade, so that the very suspicion that tobacco came from the meadows is enough to kill its sale, but the land so despised for tobacco is prized for corn, potatoes, onions, other vegetables and grass. The valley has almost half of the state's total acreage devoted to corn, about a third of that used for potatoes, and the number and quality of onions raised in the valley make it one of the minor centers for that product in the United States.¹⁴ This is the only portion of Massachusetts or all New England which compares favorably with the rich agricultural areas of New York, Pennsylvania or the prairie states.

Next to the Connecticut Valley the chief exception to the rule that poor soil makes dairying supreme is found on Cape Cod and the adjacent portions of the mainland. The Cape is a moraine, the dumping ground of the glacier, and its soil is sandy, which causes it to be well adapted to berries or small fruits. Hence it is the home of the cranberry, the principal small fruit raised in Massachusetts. To grow cranberries there are three physical requisites; plenty of sand, a bog and water. The Cape possesses all three of these in abundance, so it was the first part of the United States to become famous for cranberries, and even at the present time produces one half the entire crop for the nation.

We must frankly state, however, that the climate of Cape Cod is fully as influential a factor in its agriculture as the soil, for the cool, even temperatures give the cranberry crop a freedom from fungous

¹⁴ New York is the only eastern state that surpasses Massachusetts in onion acreage.

	Acres 1909.
Ohio	6,000
New York	5,000
Texas	5,000
California	4,000
Indiana	4,000
Illinois	3,000
Louisiana	2,000
Massachusetts	2,000

diseases that is not attained in any of the other cranberry districts.¹⁵ Furthermore, the climate has given rise to a thriving market-garden business because the spring seasons on the Cape are fully two weeks ahead of the mainland, so that the farmers have the double advantage of a climate as soft as Maryland, yet right next door to the greatest consuming market in New England. Cape strawberries appear in Boston the first week in June, and being the foremost native berries to arrive, sell for 25 to 50 cents a quart. Ten to fourteen days later the avalanche of native berries strikes the market and depresses the price to 7 cents a quart. Climate, therefore, is a large determinant of agriculture on the Cape and of course it is due to the almost all-surrounding ocean. The glacier, by dumping its burden of materials in the sea, gave the marine climate an opportunity to operate for the benefit of man, and the ice sheet also provided the sort of soil most needed for the full utilization of climate in producing early season crops.

It is worthy of note that the soil of Massachusetts is the basis of a social movement that may have consequences of grave significance. Everyone is familiar with the story of farm desertion that took place when the prairie states were opened to settlement, and also the abandonment of the land that has kept step with the growth of factories, until, as we have shown, Massachusetts is a state of cities and its people almost wholly a great group of mill operatives. If we may look for an increase in the amount of capital necessary to conduct factory enterprises on account of the ever-present tendency to transfer skill to machines, then the future of Massachusetts is dark indeed, for its population will sink lower and lower as mere tenders of machinery, provided there is no escape from this thralldom. The mechanical equipment of mills has already reached such a point of perfection that inexperienced immigrants may operate the controlling levers. The social result is that Massachusetts is inhabited by persons two thirds of whom have lived in the United States less than two generations¹⁶ and almost one third are actually foreign

¹⁵ New Jersey, Michigan, Oregon, Washington, and Long Island.

¹⁶ Native whites of native parents 32.8
 Native whites of foreign or mixed 34.8
 Foreign born whites 31.2
 Negroes 1.2

Arranged from abstract U. S. Census, 1910.

born. If Massachusetts is to perform the traditional function of the melting pot these people must have the same choice of occupations offered by cheap land that enabled our forefathers to make a place for themselves in the world. Most fortunately the glacial soil of Massachusetts will permit the aliens within her boundaries to emancipate themselves from the serfdom of factory labor, and moreover Massachusetts is a far more advantageous place for an immigrant-operative-farmer to commence his struggle for economic freedom than states such as Illinois, where the soil is much richer. The Illinois factory worker is bound to his mill toil, while the Massachusetts laborer may break the shackles if he so chooses. This statement is too startling to go unproven, but the evidence is at hand, and shown by the subjoined table:

	Mass.	Illinois	U. S.
Size of farm: Area, number of acres	77.9	129.1	138
Value per acre	\$36	\$95	\$32
Average value land per farm.....	\$2,859	\$12,270	\$4,476
Per cent. operated by owners.....	86	56	68.1
Per cent. operated by tenants.....	7	41	25.9
Per cent. operated by managers.....	7	3	6.1
Population per square mile	418.8	100.6	30.8
Per cent. population rural	7.2	38.3	53.7
Increase rural population between 1900-1910.	2.2	0.3	11
Number cities 25,000 or over.....	25	12	
Number towns 2,500 or over.....	154	144	

Compiled from U. S. Census, 1910.

The Illinois farm is sixty-six and two thirds per cent. greater in area than the one in Massachusetts, its average value of land per farm is more than four times as great, and almost half of the farms are operated by tenants; here we have a statistical picture of a landed aristocracy. Anyone who visits Illinois will see farms worth \$300 an acre, upon which tenants are struggling for existence, while the county towns are filled with the landowners living on rents. How can an immigrant working in a Chicago factory aspire to take up land and make his way upward in the world in the face of these hopeless conditions? Yet Illinois ranks third among the states in the value of products manufactured; fourth, in value of manufactured products per capita; and fifth, in the proportion of total population engaged in manufactures.

It would appear as if the people of future Illinois will fall into two classes, one the owners of land and machines, the other the workers. Under the conditions cited it would do a mill employee little good to seek the country, for he would but exchange masters. Circumstances are adjusted in Illinois to make real the nightmare of the rich growing richer and the poor growing poorer.

On the other hand, the Massachusetts farm is small, the land is cheap and tenantry is well-nigh unknown; moreover, the state offers unexampled opportunities in the matter of markets, as a glance at the figures of population and the numbers of cities will show. It is encouraging to see in every center of manufacturing in Massachusetts a slow seepage of factory workers back to the land. Immigrants working part time in the shops and part time on their farms pay for the farm—which frequently costs them as little as twenty-five dollars an acre—until the debt is removed, and then retire from the mill permanently and take their places as owners and workers of the ground. The soil despised by the previous generations of Americans may be the salvation of the next, and be a mighty influence in the amalgamation of conflicting races. The very poverty as compared with prairie soils has kept the land within the reach of the pocketbooks of poor men, and may be the means of regeneration of both the immigrants who live upon it, and the state within which it lies. The soil is by no means sterile or worked out, and when used for fruit, berries and vegetables yields a fair living, because the great market will absorb all that is produced. In the end, therefore, the curse put upon the agriculture of the state by the glacier may be lifted. The contrast, however, between the opportunity offered a poor man in Illinois and one in Massachusetts, now curiously reflecting credit to the state with the less natural endowments, is the result of conditions set up by man. As long as society permits landlordism and allows those that have to hold, in defiance of public good, then a situation like the one sketched above is possible, but if America is to follow English precedent it seems probable that before the mass of workmen are forced to accept land like much of that in Massachusetts, a change will take place in our laws and landlordism be taxed out of existence.

We have pointed out that the glacier was responsible for the early development of manufacturing in Massachusetts, because the

changes instituted by the ice sheet bequeathed to the state so many valuable power sites, and we have also shown that the poverty-stricken condition of agriculture is due to the same set of circumstances added to the disturbance of the soil. Moreover, the exceptional parts of the state where agriculture is advantageously equipped by nature owe their prominence in farming to the alterations wrought by the glacier. Manufacturing and agriculture are two industries whose present destinies were foreshadowed in the past geological era, and to them we may add the quarry industry of the state, for it uses a stone laid bare by the action of ice upon the surface of the ground.

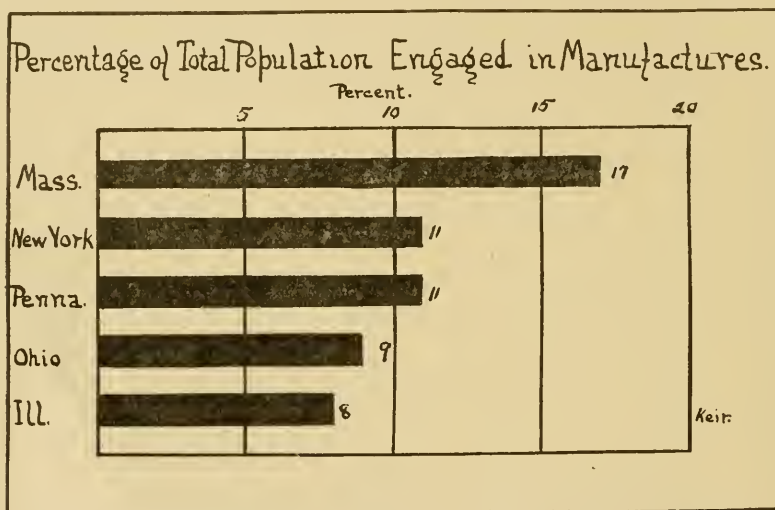


FIG. 9. PERCENTAGE OF TOTAL POPULATION ENGAGED IN MANUFACTURES.

Until the time of the glacier, granite lay buried deep beneath the surface of the earth, but the crushing burden of ice so levelled many of the hills that the interior granite lay exposed to the air when the glacier had passed away. Man has taken advantage of this circumstance to quarry the stone for uses ranging all the way from paving stones worth 25 cents a cubic foot to beautiful monuments which cost \$70 a cubic foot. Granite has so much utility for structural and ornamental purposes that it is the most valuable stone resource Massachusetts possesses, comprising 63 per cent. in value of all the stones quarried. This stone would not be available if the

glacier had not removed the overburden under which the granite was hidden.

All told, the glacier changed the land in ways that were beneficial to Massachusetts, for its water power was a boon to manufacturers, the silt in its lakes and the coarser materials at the terminal moraine have been an advantage to farmers, and rock resources have been placed at the disposal of modern quarrymen. On the other hand, the glacier has seriously limited agriculture, because it scattered debris over so much of the state, yet in the course of time even this apparent detriment may prove a boon because it has kept the land cheap and brings it within the means of poor people, who can use it to attain their economic independence.

The main features of life in Massachusetts have been controlled by two environmental factors, the first of which—the general north-south trend of the hills and valleys—was responsible for the early grouping of population along the seaboard and the Connecticut valley, and operates the same way today; the direction of land forms also caused the main lines of travel to run north and south instead of east and west, a route more desirable for political reasons. Manufacturing, agriculture and even summer visitors have been segregated by the tendency of the hills and valleys to open northward and southward. Along with this feature of the environment and fully as influential, are the changes brought about by the visitation of the glacier. The creation of water power, the alteration of the soil and the baring of rocks have done much to direct industry; for manufacturing, agriculture and quarrying in their present form, and in their positions of relative importance may be traced to these causes. Since the history, politics, the prestige and the present problems of the state have all turned about one or the other of these two environmental factors or the results that have flowed from them, we may safely grant them a place of paramount importance.

NOTE: For the plates used throughout this article the author is indebted to the Boston and Maine Railroad.

M B 2.4.2





DOBBS BROS.
LIBRARY BINDING
SEP 17
ST. AUGUSTINE
FLA.

LIBRARY OF CONGRESS



0 012 608 566 7

